

## ABSTRACT

- The invention relates to processes for the synthesis of 2-D and 3-D periodic porous silicon structures and composites with improved properties having the
- 5 advantages of porous silicon and photonic bandgap materials. Photonic crystals comprise a two dimensionally periodic or three dimensionally periodic microporous structural matrix of interconnecting, crystallographically oriented, monodispersed members having voids between adjacent members, and said members additionally having randomly nanoporous surface porosity.
- 10 The silicon nanofoam material shows enhanced and spectrally controlled/tunable photoluminescence and electroluminesce and finds use as transparent electrodes, high-lumonosity light emitting diodes (LEDs), wavelength division multiplexors, high-active-area catalyst supports, photonic bandgap lasers, silicon-based UV detectors, displays, gas sensors, and the like.